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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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Boston, MA 02210

EXAMINER

LEVITAN, DMITRY

ART UNIT	PAPER NUMBER
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2616

DATE MAILED: 06/19/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

**Supplemental  
Notice of Allowability**

Application No.

09/517,417

Examiner

Dmitry Levitan

Applicant(s)

ISSON ET AL.

Art Unit

2616

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--**

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 3/17/06.
2. ☒ The allowed claim(s) is/are 1-6, 9-17 and 20-27 renumbered as 1-23.
3. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
  - a) ☒ All    b) ☐ Some\*    c) ☐ None    of the:
    1. ☒ Certified copies of the priority documents have been received.
    2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
    3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

\* Certified copies not received: \_\_\_\_\_.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.  
**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
  - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
    - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date \_\_\_\_\_.
  - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date \_\_\_\_\_.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

- |   |   |
|---|---|
| 1. <input type="checkbox"/> Notice of References Cited (PTO-892)  | 5. <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)           |
| 2. <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                | 6. <input type="checkbox"/> Interview Summary (PTO-413),<br>Paper No./Mail Date _____ |
| 3. <input type="checkbox"/> Information Disclosure Statements (PTO-1449 or PTO/SB/08),<br>Paper No./Mail Date _____ | 7. <input checked="" type="checkbox"/> Examiner's Amendment/Comment                   |
| 4. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit<br>of Biological Material          | 8. <input type="checkbox"/> Examiner's Statement of Reasons for Allowance             |
|   | 9. <input checked="" type="checkbox"/> Other <u>Attachment A</u> .                    |

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Amendment, filed 03/17/06, has been entered.

***Drawings***

1. The drawings were received on 3/17/06. These drawings are approved.

**EXAMINER'S AMENDMENT**

2. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Daniel P. McLoughlin on 4/12/06.

The application has been amended as follows:

Claims 1-6, 9-17 and 20-27 have been amended per Attachment A.

Note. Claims have been amended to eliminate the antecedent issues and to avoid reading on the Admitted Prior Art.

***Allowable Subject Matter***

3. Claims 1-6, 9-17 and 20-27 are allowed.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dmitry Levitan whose telephone number is (571) 272-3093. The examiner can normally be reached on 8:30 to 4:30.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Doris To can be reached on (571) 272-7529. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to read 'DL' followed by a stylized name.

Dmitry Levitan  
Examiner  
Art Unit 2616

## Attachment A.

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1. A digital subscriber line transmission system comprising:
  - an inverse fast Fourier transform circuit generating successive outgoing time domain symbols without cyclic suffixes on a subscriber line from respective groups of digital frequency domain coefficients;
  - a fast Fourier transform circuit generating groups of digital frequency domain coefficients from respective incoming time domain symbols received on the subscriber line, a current incoming symbol being delayed with respect to a current outgoing symbol by a predetermined time interval; and
  - a processing circuit for making sub-carriers of a local echo of the outgoing time domain symbols orthogonal to sub-carriers of the incoming time domain symbols, said processing circuit comprising means for adding to said incoming time domain symbols an estimated echo obtained by filtering the difference between a signal portion following the end of the current outgoing symbol and a beginning portion of the current outgoing symbol, wherein said portions have a duration at least equal to said predetermined time interval.
2. The system of claim 1, ~~wherein the filter is further comprising:~~
  - a finite impulse response filter having a size adapted for processing samples of the outgoing time domain symbols only during said predetermined time interval, comprising means for continuously calculating filter coefficients from the outgoing time domain signals received and transmitted on the subscriber line.
3. The system of claim 1, wherein the predetermined time interval is equal to a maximum delay between the incoming and outgoing time domain symbols.
4. The system of claim 1, further comprising:
  - a FIFO memory receiving the outgoing time domain symbols;
  - a subtractor arranged for subtracting the outgoing time domain symbols from the output of the FIFO memory;
  - ~~said~~ a filter receiving the output of the subtractor and enabled only during said

predetermined time interval from the an end of each outgoing time domain symbol; and  
an adder receiving the output of the filter and said incoming time domain symbols.

5. The system of claim 4, wherein the FIFO memory has a size for storing only the a beginning portion of each outgoing time domain symbol, is write-enabled during said predetermined time interval from the beginning of each outgoing time domain symbol, and read-enabled during said predetermined time interval from the end of each outgoing time domain symbol.

6. In a digital subscriber line (DSL) transmission system in which at least a first outgoing symbol and a second outgoing symbol are successively transmitted, at least one incoming symbol is received, and an echo of the first outgoing symbol and an echo of the second outgoing symbol are successively received as part of an echo signal, a method comprising an act of:

(A) making sub-carriers of a first portion of the echo signal, the first portion being less than all of the echo signal, orthogonal to sub-carriers of the at least one incoming symbol by replacing a the first portion of the echo of the second outgoing symbol with an estimation of a first portion of the echo of the first outgoing symbol.

7. (Canceled)

8. (Canceled)

9. The method of claim 6 wherein the first portion of the echo of the second outgoing signal and the first portion of the echo of the first outgoing symbol have a same length that is less than or equal to a maximum delay between transmitted and received symbols.

10. The method of claim 9 wherein:  
~~each of~~ the first outgoing symbol and the second outgoing symbol have a same total length; and

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the length of the first portion of the echo of the second outgoing symbol and the first portion of the echo of the first outgoing symbol does not exceed 5% of the total length.

11. The method of claim 6 wherein the act A) comprises acts of:
- A1) obtaining a difference between a first portion of the first outgoing symbol and a first portion of the second outgoing symbol;
  - A2) applying an estimated transfer function of echo generation to the difference to generate an echo compensation signal; and
  - A3) adding the echo compensation signal to at least the first portion of the echo of the second outgoing symbol.

12. The method of claim 11, wherein the act A1) includes an act of:  
applying a one symbol delay to at least the first and second outgoing symbols.

13. The method of claim 12, wherein the act A2) includes an act of:  
passing the difference through a finite impulse response filter having the estimated transfer function of the echo generation.

14. The method of claim 12, wherein the act A2) includes an act of:  
calculating the estimated transfer function based at least on a plurality of outgoing symbols and a plurality of incoming symbols.

15. The method of claim 14, wherein each outgoing symbol and each incoming symbol has a total symbol length, and wherein the act of calculating the estimated transfer function includes an act of:  
calculating the estimated transfer function based only on a portion of the total symbol length.

16. The method of claim 15, wherein the act of calculating the estimated transfer function includes an act of calculating the estimated transfer function based on approximately 5% of a total number of samples of each symbol.

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17. In a digital subscriber line (DSL) transmission system in which at least a first outgoing symbol and a second outgoing symbol are successively transmitted, at least one incoming symbol is received, and an echo of the first outgoing symbol and an echo of the second outgoing signal are successively received as part of an echo signal, an apparatus comprising:

a circuit to make sub-carriers of a first portion of the echo signal, the first portion being less than all of the echo signal, orthogonal to sub-carriers of the at least one incoming symbol, the circuit operative to replace a the first portion of the echo of the second outgoing-symbol with an estimation of a first portion of the echo of the first outgoing symbol.

18. (Canceled)

19. (Canceled)

20. The apparatus of claim 17, wherein the first portion of the echo of the second outgoing signal and the first portion of the echo of the first outgoing symbol have a same length that is less than or equal to a maximum delay between transmitted and received symbols.

21. The apparatus of claim 20, wherein:  
the first outgoing symbol and the second outgoing symbol have a same total length; and  
the length of the first portion of the echo of the second outgoing signal and the first portion of the echo of the first outgoing symbol does not exceed 5% of the total length.

22. The apparatus of claim 17, wherein the [[a]] circuit is configured to:  
obtain a difference between a first portion of the first outgoing symbol and a first portion of the second outgoing symbol;

apply an estimated transfer function of echo generation to the difference to generate an echo compensation signal; and

add the echo compensation signal to at least the first portion of the echo of the second outgoing symbol.



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23. The apparatus of claim 22, wherein the a circuit includes at least one delay unit configured to apply a one symbol delay to at least the first and second outgoing symbols.

24. The apparatus of claim 23, wherein the [[a]] circuit further includes a finite impulse response filter, coupled to the at least one delay unit and having the estimated transfer function of the echo generation, to process the difference.

25. The apparatus of claim 24, wherein the [[a]] circuit further includes at least one calculating unit configured to calculate the estimated transfer function based at least on a plurality of outgoing symbols and a plurality of incoming symbols.

26. The apparatus of claim 25, wherein each outgoing symbol and each incoming symbol has a total symbol length, and wherein the at least one calculating unit is configured to calculate the estimated transfer function based only on a portion of the total symbol length.

27. The apparatus of claim 26, wherein the at least one calculating unit is configured to calculate the estimated transfer function based on approximately 5% of a total number of samples of each symbol.